



1936

General Business Conditions

THE severe weather experienced over a great part of the country has been the chief topic of comment in the trade reports during February. In some lines the effect of the unusual cold has been stimulating; it has helped merchants clean up their stocks of Winter goods, and coal production has risen to the highest figure in six years. But these of course are the exceptions. On the whole business has been retarded. Snow and ice have hampered transportation, and the movement of merchandise and miscellaneous freight has fallen behind last year. Preparations for Spring business have been slowed down; the number of buyers in the wholesale markets has been less than a year ago, and in many general merchandise lines their purchases have been smaller.

Retail trade reports are spotted. In most sections the weather has not prevented moderate gains over last year, and house furnishing sales have brought good results, but business in apparel has been slack. New York City department stores in the first half of the month had a gain of 5.3 per cent over 1935. In January, also a month of bad weather, department stores over the country averaged a 7 per cent increase, but the decline from December to January was more than seasonal, and January 1935, with which the comparison is made, was a relatively poor month.

The greatest of the unfavorable effects of the weather has been upon automobile deliveries. Naturally with highways in bad condition automobile sales have fallen off, "driveaways" from the assembly plants have at times been suspended, and production has been curtailed to the lowest level since the opening of the new season, on November 1. It is probable that February assemblies have not exceeded 300,000 cars, which compares with 381,000 in January and 354,000 in February, 1935. Operations in the parts and materials industries have been affected proportionately. The situation is unfortunate from the standpoint of sales of used

Economic Conditions Governmental Finance United States Securities



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cars, for stocks are heavy and dealers need to keep them moving.

Recession Considered Temporary

Since they are chiefly due to the weather, these evidences of backwardness in business have had no appreciable effect upon sentiment. It is recognized that sales lost from this cause are usually recovered. Easter does not fall until April 12, which still leaves time for Spring buying and wholesale gains are expected in March. In automobile sales February would likely be a slow month under any circumstances, for the first rush to buy the new models is over, and Spring is still a month away. After this interruption the usual Spring improvement is considered a certainty. Meanwhile the curtailment in assemblies keeps dealers' stocks down to conservative figures.

As these Letters have pointed out, many observers were expecting a pause in the upward movement of business during the first quarter, as a natural sequence to the sharp rise in the second half of 1935. There was no lack of prophecy of a recession in automobile sales, and of a temporary drop in the general indexes of business. Now that these expectations are being realized, the decline is being borne with patience.

Moreover, the reasons why it was believed the recession would be temporary, namely, improvement in the capital goods industries and Government expenditures, still hold. The steel industry has turned in an encouraging performance, with operations climbing to around 54 per cent of capacity, against an average of 51 in January. The notable fact is that the rise occurred despite the falling off in automobile orders, which for a long time have given steel mills their chief support. Miscellaneous users have been taking more steel, and structural awards have been considerably ahead of a year ago, but the important increase has been in railway orders. The magazine "Steel" estimates that railroad buying has reached 600,000 tons since December 1. Orders for steel rails have totaled 371,000 tons, against

111,000 in the same period a year earlier; 17,500 freight cars have been ordered, against 940; to date this year 53 steam locomotives have been ordered, compared with 28 in all of 1935.

This is improvement precisely where it is needed, namely, in the heavy equipment field. Furthermore, machine tool orders have held up, the total in January having been 12.7 per cent over December and 69.2 per cent over a year ago. Building contract awards in January were more than double the January, 1935, figures, and although the greatest gain was in public works privately financed contracts increased 45 per cent. In the first half of February the increase in residential contracts was 82 per cent, and in the total 66 per cent.

Thus 1936 is making a fair start along the lines particularly hoped for, and the early evidence, at least, is that the predictions of a fair improvement in building and equipment lines were well-founded. And since the first of the year it has become certain that Government expenditures, by reason of the bonus, will be larger than last year instead of smaller. With all the concern as to future taxes and the uncertain outcome of the fiscal policy, the first effect of the expenditures is stimulating.

It is plain that business sentiment is impressed more by these factors than by the temporary recession. The firm market for industrial shares, despite conservative expectations of a reaction, exhibits the general feeling. Also, prices of some of the industrial raw materials, notably non-ferrous metals and rubber, have been strong.

The consumer goods industries, which after their big year in 1935 are not expected to make another gain this year, offer little occasion for comment. Cotton and woolen mill operations have receded slightly, and silk mill activity rather more. Rayon conditions are satisfactory. Need for cotton goods is overcoming the difficulties of doing business arising out of processing tax uncertainties, and advance indications are for a good start on heavyweight woolens, while many woolen mills still have large unfilled orders.

Large Payments to Farmers Assured

The passage of another month since the A.A.A. was declared unconstitutional has served to dispel any remaining fears as to farm buying power this year. In the first place, the average level of farm prices is still unaffected by the decision. The farm products group of the Bureau of Labor Statistics' price index stood on February 15 at 79.9 compared with 79.3 on January 4. Among the individual commodities, cotton and cottonseed oil are lower, also cattle and lambs, which were not affected by the A.A.A. On the other hand, hogs and lard, corn, and the other feed grains

are all higher, while wool, butter and eggs have advanced substantially.

Moreover, the Administration's substitute farm program has been rushed through Congress; and since it sets up as its goal, along with soil conservation, the restoration of the pre-war parity between the net incomes of farmers and city people, and gives the Secretary of Agriculture broad powers for that purpose, the new Act may be expected to lead to the distribution of as much money to the farmers as the old one did.

Within the past month Congress has appropriated funds to make payments still due on the old A.A.A. contracts, which total almost \$300,000,000. The amount to be put at the disposal of Secretary Wallace for payments under the new Act has not yet been determined, but according to Washington reports is expected to be around \$500,000,000 this calendar year, which is about the same as the payments under the A.A.A. in each of the past two years. Smaller appropriations for other purposes will add to the total. With the Treasury scheduled to pay out money at this rate, and prices holding, implement companies and others selling to farmers evidently have no reason to worry about their customers' buying power.

It is too early to express a general opinion as to the effectiveness of the new program in controlling crop acreages. Under the limitations laid down by the Supreme Court, the Government will not be able to exert the same compulsion as under the A.A.A.; in fact, the Secretary of Agriculture is not permitted to enter binding contracts with farmers to curtail their production. Instead, cash inducements will be offered to farmers who adopt recommended soil conservation practices. The intent is the same, and the officials hope the results will be the same.

The Cotton Situation

The action of the cotton market, with new crop months dipping again below 10 cents, indicates that there is more fear of a fall in the price of cotton as the year goes on than of any other farm product. Reports from the South state that an increase in the acreage is probable, and also that the area will be intensively cultivated. Fertilizer tag sales thus far have been larger than last year and more mules and farm implements have been purchased. Labor is plentiful, soil moisture is satisfactory, and the low temperatures tend to reduce the number of boll weevil surviving the Winter.

If it turns out that the next cotton crop is larger and the price lower, there are many reasons for thinking that the change will be more beneficial than otherwise. The effects of the Government cotton program were described in this Letter last month and on earlier occasions, and we lack space to repeat the discussion. The essence

of the matter is that the world consumption of American cotton has been seriously reduced by the policy of curtailing the supply and supporting the price, while people who have been accustomed to grow cotton have had to go on relief. This policy was justified by its proponents on the ground that the income of cotton producers otherwise would be intolerably low. However, the crop reduction program has reduced the incomes of many other people, including those who handle and transport cotton and those who have been forced to stop growing it, and it is by no means certain that it has raised the net income even of the cotton growers, whose costs on the smaller production have necessarily been higher.

During the past month, the Bureau of Agricultural Economics of the Department of Agriculture has made public a report of an exhaustive investigation of cotton production in the United States, which is authoritative and informative. The report contains an analysis of how various classes of cotton producers fared in 1933 and 1934, in comparison with how they would have fared without the A.A.A. Of course this procedure involves estimates of what the production and price would have been without the A.A.A. (the price estimate is 7.25 cents for 1933 and 8.75 for 1934), and these estimates may be faulty.

Taking them for what they are worth, the study reveals the striking fact that in a number of the cases analyzed the increase in income was less than the benefit payments received, indicating that these growers would have fared better if the Government had simply given them the money without requiring curtailment of production. Moreover, in the case of some share-croppers, the net income *including* the Government benefits was less than they would have received if they had made a normal crop at lower prices.

Substantiating the above, we give the following summaries of income analyses presented in the report:

A study of share-cropper incomes on a few plantations in Mississippi in 1934 showed that the cash income per family including benefit payments was \$2.87 less than it would have been without the A.A.A. program.

In the high plains area in Texas in 1933, the income of operators using share-croppers was increased \$2.30 per acre by the plow-up campaign. This income included Government payments of \$3.30 per acre; thus the net income, exclusive of Government payments, was \$1 less than it would have been without the crop reduction. In 1934 in the same area, the Government payments were \$2.97 per acre and the income increase resulting from the program was only \$2.48 per acre, a reduction in income excluding the Government payments of 49 cents.

In the Upper Piedmont area of South Carolina in 1933 the income of operators using share-croppers was increased \$3.03 per acre, which again was less than the Government payment of \$5.10. In the same area in 1934 the income increase was only \$3.81, although the Government payment was \$4.50. Share-cropper incomes in the same area in 1934 were increased only 10 cents per acre by the A.A.A. program, although this income included 50 cents per acre of Government payments.

The report also makes the important point that the returns to farmers and farm labor in the South from cotton growing are far greater than from any other commercial farm enterprise which can be conducted there, with limited exceptions not generally applicable. Yet the cotton program has led to an increase in the commercial production of corn and other products which can be grown more cheaply in other sections, while foreign countries have gladly undertaken to grow cotton, and have cut into our accustomed market to the extent of perhaps two million bales annually.

For the light it throws on the policy of crop restriction, this report is a very important document. It strengthens the other evidence against the cotton program. Its immediate interest, applying to the general business situation, is the indication given that the South can look upon the prospect of a larger crop and moderately lower prices without expecting any material reduction of its total income from cotton. From every other viewpoint, of course, the change would be beneficial.

Money and Banking

There has been no important change in the money situation during the past month. Excess reserves of the banks have held within a range of 3 to 3.1 billions, the authorities evidently being content to see them go no higher. This is clear from the fact that the Treasury continues to carry about \$475,000,000 of its bank balances with the Federal Reserve Banks, as against the usual practice of carrying most of these funds with the commercial banks. Money in circulation showed a seasonal increase of \$82,000,000, and on February 26 was \$333,000,000 greater than a year ago, reflecting the higher level of general business activity, employment and payrolls. Monetary gold stocks declined \$16,000,000 in consequence of gold exports and earmarking for foreign account.

The small loss of gold sustained during the month was of interest chiefly because it was the first since September, 1934, when \$18,000,000 net was exported, because of uneasiness over the Government's silver purchase program just getting under way. The movement last month likewise originated in nervousness over the currency. Prospects of a greatly increased budgetary deficit resulting from passage of soldiers' bonus legislation and Supreme Court invalidation of processing taxes, a drive by the inflationists in Congress to pay the bonus with currency issues, and rumors of impending devaluation and other radical monetary steps were the disturbing influences. Altogether, approximately \$21,000,000 gold was shipped out of the country.

In addition to these exports, \$10,000,000 of gold was earmarked by the Treasury for account of the Chinese Government. This transaction was explained as part usage of the

proceeds of a sale of 50,000,000 ounces of silver by the Chinese Government to the United States Treasury some months ago. It is assumed that this silver was bought by the Treasury with a view to aiding the Chinese Government in accumulating a fund here for the purpose of exchange control.

Counting both export shipments and earmarking, total gold sold to foreign ownership during the month amounted to \$31,000,000. Due to a scattering of gold imports and to continued Treasury purchases of gold from domestic production, the net reduction in gold stocks was much smaller, as indicated above.

Weakness in dollars proved to be of short duration, the rate rallying above the gold export point immediately upon the denial of unsettling rumors and collapse of the currency inflation moves in Congress. Such fluctuations demonstrate anew the sensitiveness of public opinion in matters affecting the currency, and should be a warning against unwarranted assumptions as to the invulnerability of the dollar. It is clear, however, that the dollar has great natural strength; and apparently a good part of the foreign capital that has been coming to this country has come in the belief that genuine recovery is in progress here, hence is not to be stampeded readily. In view of the steady flow of capital to these shores despite much that has been done and said not calculated to diminish the uncertainties regarding the currency, it is interesting to speculate what the movement would have been had the monetary and fiscal policies been along different lines.

The Rise of Bank Deposits

The increase of bank deposits, which has been so prominent a feature of the banking situation for the past two years, has gone further since the first of the year. Demand deposits of the weekly reporting member banks, adjusted to exclude interbank and foreign deposits, increased by more than \$200,000,000 to a new high level. Foreign deposits declined \$38,000,000 during the period of dollar weakness, after having been built up over \$300,000,000 during 1935. With the total of domestic demand deposits at the present time nearly 2½ billions greater than a year ago it is not difficult to see why business and the stock market have been enabled to go ahead so rapidly with so little dependence upon bank borrowing.

Taking the year as a whole, the main source of the increase in deposits has been the increase in bank purchases of Government securities—which for the weekly reporting banks amounted to \$1,418,000,000—and the heavy inflow of gold. Aggregate loans have not increased, and in the case of these banks were actually a shade lower on February 19 this year than on the corresponding date a year ago. In view

of the prospects that Government expenditures will continue far in excess of revenues, and that the deficit will be financed largely by bank credit, there seems no reason to anticipate a halt in the upward trend of bank deposits unless something happens to cause a large outflow of gold. As to the last, the dollar only recently has given a demonstration of its strength, though what would happen in the event of the devaluation of the gold bloc currencies is admittedly more of a question.

Cheap Money Promoting Record Refunding

The current era of cheap money, and high prices of outstanding bonds, continue to promote corporate refinancing on an unprecedented scale. Last year refunding issues aggregating \$3,271,000,000 were the largest in volume of any year on record, and this year the total bids fair to be even larger. January's total was in excess of that of January last year, and February apparently has likewise beaten February a year ago. In addition, a huge amount of refunding is in prospect, some of which already has been registered with the Securities and Exchange Commission. Registration with the Commission of a proposed issue of \$40,000,000 first mortgage bonds of the Jones & Laughlin Steel Corporation for the purpose principally of financing new construction and equipment was noteworthy as marking the largest issue so far registered involving new money for expansion.

Rates and terms upon which refinancing is being done emphasize the extraordinary condition of the money market. With the offering at par of \$55,000,000 3¼ per cent bonds by the New York Edison Company, yields for new long-term corporate financing struck a new low for the present period. Such terms represent an important decrease in the debt burden upon industry; at the same time, they mean a heavy sacrifice to capital, refuting the charge that capital has not borne a share of the losses of the depression.

Prices of outstanding high grade bonds moved forward on a broad front, following irregularity caused by the same influences responsible for the flurry in the dollar. On denial of inflationary rumors, and assurance that funds to pay the soldiers' bonus would be raised in the regular way, Government bonds strengthened and some of the long-term high coupon issues sold at new high prices for all time. High grade corporate and municipal issues were firm, with advances in second grade municipals a feature of the market. On February 26 the Standard Statistics index of the yield of 60 high grade bonds reached 3.88, a new low since the computation of the index was commenced in 1900.

Short-term money rates were virtually unchanged during the month. Nine-months'

Treasury bills were discounted at 0.074 per cent on February 26, compared with 0.096 per cent at the close of January.

Manufacturing and Trading Profits in 1935

Published annual reports of industrial corporations for the past year show, in a large majority of cases, an increase in both gross income and net profits as compared with 1934. Commencing about the middle of last year there was a marked rise in general business activity that was reflected in greatly increased sales, purchases, employment, payrolls and profits. The fourth quarter, which normally brings a slowing down in many of the industries, was unusually active last year, largely because of the advance of three months by leading automobile manufacturers in the presentation of new models and in production schedules. This shift of seasons, and the large number of cars that was produced and sold, not only caused a large addition to the year's volume of receipts and payments of automo-

bile manufacturers and dealers, but benefited numerous other industries as well, particularly auto accessories, steel, non-ferrous metals, machinery, electrical equipment, rubber tires, plate glass, leather and fabric upholstery, chemicals, paints and lacquers, petroleum and railroad transportation. In other words, the change in seasons had the effect of crowding into the last quarter of 1935 a considerable amount of business and profits that otherwise would have fallen in 1936. This fact should be borne in mind in appraising the year's results.

The Rate of Profits

A tabulation of the reports of some 895 industrial and trading corporations shows combined net profits, less deficits, of approximately \$952,000,000 in 1935, which compares with \$648,000,000 for the same companies in 1934 and represents an increase of 46.9 per cent. These companies had an aggregate net worth of \$14,413,000,000 at the beginning of

INDUSTRIAL CORPORATION PROFITS FOR THE YEARS 1934 AND 1935

Net Profits Are Shown After Depreciation, Interest, Taxes, and Other Charges and Reserves, but Before Dividends.

Net Worth Includes Book Value of Outstanding Preferred and Common Stock and Surplus Account at Beginning of Each Year.
(In Thousands of Dollars)

No.	Industry	Net Profits Years		Per Cent Change	Net Worth January 1		Per Cent Change	Per Cent Return	
		1934	1935		1934	1935		1934	1935
5	Agricultural Implements	\$ 1,905	\$ 12,739	+568.7	\$ 116,730	\$ 115,757	- 0.8	1.6	11.0
9	Amusements	6,123	9,804	+ 60.1	177,827	180,125	+ 1.3	3.4	5.4
21	Apparel	4,063	6,256	+ 53.9	105,515	104,199	- 1.2	3.8	6.0
14	Automobiles	93,072	197,069	+111.7	1,187,802	1,176,370	- 0.9	7.8	16.7
35	Auto Accessories	11,190	26,117	+133.3	152,713	156,231	+ 2.3	7.3	16.7
17	Bakery	17,269	15,224	- 11.8	287,270	276,296	- 3.8	6.0	5.5
43	Building Materials	12,423	15,329	+ 23.3	428,457	420,987	- 0.6	2.9	3.6
19	Chemicals	61,701	79,019	+ 28.0	713,187	728,876	+ 2.2	8.6	10.8
10	Coal Mining	5,779	2,638	- 54.3	220,503	162,489	-26.3	2.6	1.6
14	Containers	43,022	42,936	- 0.2	347,646	361,316	+ 3.9	12.3	11.8
32	Cotton Mills	3,029	D-5,809	-	185,150	171,619	- 7.3	1.6
12	Drugs and Sundries	23,616	23,936	+ 1.3	123,497	125,060	+ 1.2	19.1	19.1
20	Electrical Equipment	6,308	9,945	+ 57.6	141,018	145,450	+ 3.1	4.5	6.8
47	Food Products—Misc.	62,121	58,152	- 6.4	620,557	623,689	+ 0.5	10.0	9.3
18	Hardware and Tools	3,146	5,285	+ 67.9	73,965	71,105	- 3.8	4.2	7.4
14	Heating and Plumbing	3,678	15,375	+318.0	170,741	168,831	- 1.1	2.1	9.1
34	Household Gds. and Sup.....	19,191	24,486	+ 27.5	240,672	239,140	- 0.6	7.9	10.2
41	Iron and Steel	D-18,417	43,387	+	3,454,867	3,386,673	- 1.9	1.2
27	Liquors	13,700	11,618	- 15.1	81,418	91,462	+12.3	16.3	12.7
42	Machinery	2,873	8,143	+183.4	129,434	120,069	- 7.2	2.2	6.7
6	Meat Packing	24,190	25,715	+ 6.3	604,180	553,383	- 8.4	4.0	4.6
18	Mdse.—Food Chains	14,027	12,715	- 9.3	145,165	144,921	- 0.2	9.6	8.7
22	Mdse.—Other Chains	58,635	56,533	- 3.5	386,766	404,770	+ 4.6	15.2	13.9
16	Mdse.—Dept. Stores	2,291	4,225	+ 84.4	137,492	138,577	+ 0.8	1.6	3.0
24	Mdse.—Wholesale, etc.	9,655	7,963	- 17.5	116,187	121,059	+ 4.1	8.3	6.5
15	Mining, Non-ferrous	13,691	28,213	+106.0	729,219	746,104	+ 2.3	1.8	3.7
22	Paper and Products	5,953	6,774	+ 13.6	175,808	175,757	-	3.3	3.8
36	Petroleum	19,364	31,786	+ 64.1	832,375	798,322	- 4.1	2.3	4.0
16	Printing and Publish.	9,412	10,802	+ 14.7	92,430	93,499	+ 1.2	10.2	11.6
13	Railway Equipment	D-2,716	D-2,119	+	319,047	304,529	- 4.5
12	Rubber Tires, etc.	9,940	11,802	+ 18.7	258,266	241,862	- 6.3	3.8	4.8
13	Shoes	13,192	13,574	+ 2.9	162,665	156,918	- 3.5	8.1	8.6
15	Silk and Hosiery	994	2,679	+169.5	55,099	54,039	- 1.9	1.8	4.9
13	Sugar	7,223	8,213	+ 13.7	137,504	128,714	- 6.4	5.2	6.3
19	Textile Products—Misc.	1,012	7,136	+605.1	148,028	142,152	- 3.9	0.7	5.0
20	Tobacco	64,122	62,640	- 2.3	535,565	525,392	- 1.9	11.9	11.9
10	Wool	D-8,114	4,323	+	127,706	117,997	- 7.6	3.6
72	Miscel.—Manufacturing	25,753	49,210	+ 91.0	465,484	475,061	+ 2.0	5.5	10.3
57	Miscel.—Services	3,243	7,886	+143.1	270,921	264,168	- 2.5	1.2	3.0
895	Total	\$647,659	\$951,719	+ 46.9	\$14,653,876	\$14,412,968	- 1.6	4.4	6.6

D- Deficit.

last year, upon which the average annual rate of return was 6.6 per cent in 1935 as against 4.4 per cent in 1934.

These average rates of return for a limited number of the leading companies indicate merely the trend of earnings and of course do not provide an accurate measure of average return for industry as a whole, which always runs at a much lower level. Moreover, the percentage return upon net worth now makes a much more favorable comparison with prior years than do the actual profits as reported, for the reason that the heavy writing down of capital and surplus since 1929 has reduced the base upon which rate of profits is calculated. Statistics for all manufacturing corporations in the United States show that aggregate net worth declined from \$52,695,000,000 at the end of 1929 to \$43,342,000,000 at the end of 1933, and at that time, the latest date for which figures are available, stood at the lowest point since 1925. This means that in a four-year period the manufacturing corporations paid out for wages, materials and dividends, and made charges against capital of \$9,353,000,000 more than they took in.

An examination of the reports of individual companies, and of the accompanying summary by major industrial groups, will show that, in addition to the automobile and allied lines, steel and various metal and machinery industries already noted, a further recovery in earnings was made in numerous other divisions of manufacturing. Better farm incomes last year permitted a substantial increase in purchases of agricultural implements and tools. The revival of residential building, combined with larger expenditures for modernization and repairs, caused a marked expansion in sales of the various building materials, paints and hardware, heating and plumbing supplies. Mechanical refrigerators and many types of electrical household appliances made an excellent record.

On the other hand, a decline in profits, despite an increase in sales, was suffered by numerous companies in lines such as cotton goods, baking, dairy products, meat packing, miscellaneous food products, tobacco and liquors. Most of these lines had to contend with higher raw material costs and all of them felt the burden of the A.A.A. processing taxes and other taxes. Some branches of the textile industry, however, such as woolen and worsted goods, silk and hosiery, upholstery, carpets and miscellaneous textile products, as well as apparel, did better last year.

Builders of locomotives, freight and passenger cars and other classes of heavy railway equipment and supplies have not yet participated to any sizeable extent in the upward cycle of business, except in the case of electric locomotives and motorized trains. The

subnormal level of expenditures for maintenance and equipment during recent years suggests the existence of an accumulated demand that must be met sooner or later. Sales thus far in 1936 have shown a sharp pick-up. A large potential demand is also being built up for boilers, turbines, generators, transformers, transmission cable and other capital goods used by the electric light and power industry in meeting the requirements of future growth in the consumption of electric current.

Grocery and other chain store systems practically all made an increase in volume of sales last year, but the profits of many companies were down because of the rise in operating costs, particularly the growing burden of taxes on trade.

Results for All Manufacturing Corporations

The group of 895 corporations is representative of important corporations, whose securities are widely held and listed on the stock exchanges. For this reason their earnings are made public promptly, whereas the results for all corporations are available only from the official publications a year or more later. Thus we have used this tabulation for comparisons, and as significant of the business trend, but always with the comment that average profits of the leading group might be expected to range above the average for all corporations. It should be understood that the percentage gains in 1935 over 1934 are mainly significant of recovery from depression; they should not be confused with percentage of profits on either net worth or gross income.

The latest official figures available for all manufacturing corporations in the United States are those for 1933. Because of the widespread interest in the subject, and the many erroneous ideas in circulation as to the exorbitant profits made by industry and the assertion that earnings have been withheld instead of paid out, a condensed summary for the years since 1921 is given below of the gross income, statutory net income or deficit after taxes, interest and cash dividends paid, all taken from

All Manufacturing Corporations in the United States
(In Millions of Dollars)

Year	Gross Income	Wages Paid	Inter. Paid	Taxes Paid	Net. Inc. \$	Net Inc. to Gross	Divid. Paid \$
1921..	\$38,442	\$8,202	\$ 633	\$ 793	\$ D-473	D-1.23%	\$1,216†
1922..	44,683	*	622	860	2,251	5.04	1,308
1923..	56,221	11,009	611	986	3,086	5.49	1,761
1924..	53,911	*	608	937	2,834	4.33	1,651
1925..	60,830	10,730	622	1,077†	3,154	5.18	1,908
1926..	62,495	*	657	1,139	3,124	5.00	2,116
1927..	63,723	10,849	677	1,065	2,580	4.05	2,226
1928..	67,273	*	710	1,118	3,366	5.00	2,507
1929..	72,132	11,621	712	1,161	3,862	5.35	2,575
1930..	58,650	*	698	952	801	1.36	2,613
1931..	44,033	7,186	607	731	D-988	D-2.24	1,894
1932..	31,977	*	540	647	D-1,906	D-5.97	1,115
1933..	35,150	5,262	460	852	D- 3	D-0.01	1,009
Avg.	53,040	9,265	627	948	1,630	3.07	1,838

D- Deficit. \$ Excluding intercorporate dividends paid and received. * Not available. † Partly estimated.

the Treasury Department reports, together with the wages paid in the manufacturing industries as taken from the biennial census of the Department of Commerce.

Taking the entire thirteen-year period from 1921 through 1933, the average annual gross income of the manufacturing industries was \$53,040,000,000. Average net income ranged from a profit of 5.49 per cent on sales in 1923 to a loss of 5.97 per cent in 1932, and averaged \$1,630,000,000, equal to 3.07 per cent on sales. Dividends paid averaged \$1,838,000,000, or 3.5 per cent of sales, and were \$2,711,000,000 in excess of reported earnings over the period.

For every dollar paid to shareholders for the use and risk of capital, about 52 cents was paid in taxes to the federal and local governments.

Wages paid averaged \$9,265,000,000 and represented 17.5 per cent of gross income and nearly six times net income. These figures for wages paid include only the labor directly employed, but of the other major expenses of manufacturing such as cost of goods, materials and supplies purchased, coal, electric power, freight, taxes, insurance, advertising, etc., the greater portion went to labor indirectly. Even in the case of interest paid, which is not a major item and made up only 1.8 per cent of total expenses during the period under review, a part represented merely intercorporate interest and a part of the remainder eventually reached the wage earners via the savings banks and life insurance companies or as personal holders of stocks or bonds.

Between 1929 and 1933, total sales and other income dropped from \$72,132,000,000 to \$35,150,000,000 or by 51.2 per cent. Net statutory income after taxes changed from a profit of \$3,862,000,000 to a deficit of \$3,000,000. Interest paid, a more or less fixed charge, declined from \$712,000,000 to \$460,000,000 or by 35.4 per cent. Cash dividends paid, including preferred dividends but excluding intercorporate dividends, dropped from \$2,575,000,000 to \$1,009,000,000 or by 60.9 per cent. Wages paid declined from \$11,621,000,000 to \$5,262,000,000 or by 54.7 per cent.

These figures show that conditions since 1929 have been abnormal. Industry and business have been disorganized, with disastrous results to both capital and labor. Capital has not profited at the expense of labor; they have suffered together, as in every other depression. Capital and labor are so closely allied and mutually dependent that they prosper or suffer together, inevitably. See following article on "Wealth and Its Distribution."

Great Britain's Recovery

"By slow degrees," says the London "Economist," "the annual general meetings of the leading British joint-stock banks have become

public occasions". The chairmen of these great institutions discourse upon the economic situation, national and international problems and policies, and related subjects of public concern, upon which their views are significant by reason of their distinguished position.

The full reports of these annual meetings, held in January, have now reached this country, and the discussions are of special interest this year, in view of the rise in British business activity in 1935 to a higher level than it had reached even in 1929. This is a much better showing than the United States has made, for our industrial production as measured by the Federal Reserve Board's index averaged during 1935 about 24 per cent below 1929. To be sure, British industries had no such boom in the late '20s as occurred in this country, hence no such abnormal peak to drop from; the depression was relatively not as deep, and the distance to be recovered not as great. Nevertheless, Great Britain was involved as severely in the world depression, at its onset, as any other country. She was even then struggling with readjustments required by the post-war shifts of trade, and within two years after 1929 she suffered the loss of one-half of her export trade, in value, with consequences of course greater than they would have been in a more self-contained country.

Despite all difficulties, each year since 1932 the chairmen have been able to report steady progress out of the depression, with scarcely an interruption in the upward curve. Industrial output as a whole set a new high record in 1935. The number of workers in active employment is the greatest in the nation's history, and although the total unemployed is still nearly 1,900,000 (partly accounted for by the increase of population and decline of emigration) this figure is the lowest since June, 1930. The increase in home building continues the feature of all reports; the Economist's index of building activity, based on the year 1924 as 100, was 238 in December, compared with 204 one year earlier and 132.5, the 1929 average. The iron and steel industry has been working "with all departments occupied at full pressure"; its production last year was substantially higher than in 1929, and nearly double the low point of 1932. The engineering industry has improved, and has good orders on hand. The electrical industry has had a sensational rise.

Along with this improvement consumer purchasing power has naturally increased. Retail trade has continued to gain, and most of the industries making consumer goods, and those providing entertainment, have prospered. Profits of joint-stock companies have increased.

The Foreign Trade Figures

Moreover, a slight gain in foreign trade has occurred, the figures being the best in four years. Exports of British products increased

7.6 per cent over 1934, and re-exports also were larger. Although imports increased, the excess of imports over exports of merchandise was reduced by £8,400,000, and including silver the adverse balance was about £32,500,000 less. As receipts from invisible items such as shipping and insurance services and returns on foreign investments were larger, the balance of payments showed a substantial improvement over the two preceding years, and was favorable to the extent of £37,000,000.

Of course these trade gains leave the figures still far below pre-depression levels. Compared with 1929, exports of British products were 42 per cent lower in value, and 25 per cent in tonnage. The loss of trade has been greatest in the older industries, such as coal, cotton manufactures and apparel, and these industries continue depressed. Exports of iron and steel and machinery likewise are far short of the 1929 level, in volume as well as value, though they have recovered substantially since 1932. On the other hand, some of the newer industries have raised their exports to higher figures, in volume at least, than in the pre-depression years. They include chemicals, manufactures of non-ferrous metals, machine tools, airplanes and motor vehicles and parts, and to some degree electrical appliances and rayon textiles.

The shipping industry has improved in about the same degree as the foreign trade figures. The movement of freight is the best since 1930, the tonnage of ships laid up is the smallest since the beginning of that year, and the tonnage under construction the largest in five years.

Views of the Bank Chairmen

It is natural and proper that the reports of the British bank chairmen should express the gratification with which the British people look upon this record of progress. It was also to be expected that in making a critical analysis of the situation, considering the 1,900,000 unemployed, the reduced foreign trade and other evidences of disorganization and depression, the chairmen would not take a complacent view of the outlook. In almost all cases they recognized that the recovery has been largely domestic, pointed to the loss of trade with non-Imperial countries and the depression of the industries dependent on world trade, and deplored the restrictions on trade and the lack of freedom and stability in the exchanges.

On balance, however, the majority opinion plainly holds that the domestic improvement will continue. Some referred to prospective Government expenditures, for public works or armament, as the reason; and this supplies a comment upon the difficulties that are still in the way of self-supporting prosperity. However, the fact that the budget has been truly balanced for five years, without recourse to illusory makeshifts, and tax rates reduced, causes Government expenditures to be dif-

ferently regarded by business men in Great Britain than they are here. The Hon. Rupert E. Beckett, of the Westminster Bank expressed this view:

It is probable that the activity of the building trades, so far at least as house-building is concerned, is approaching its peak, and that we shall see within a year or so a gradual slackening of pace. It is pertinent to ask whether this slackening will impair our economic recovery. Fortunately, such an outcome is unlikely, for the Government, by its encouragement of railway, road and public work schemes, has embarked upon an expansionist policy at the very time when it is calculated to produce the maximum benefit. This policy has given renewed confidence to industry, and there is every indication that expenditure upon capital equipment is likely to continue on an increasing scale. This is precisely the form of expansion most to be desired, and it is because the recovery in this country began with the industries producing capital goods, spreading later to those producing consumers' goods, that I regard it as more soundly based than the recovery movement in some other countries.

Readjustments Carried Out

It goes without saying that the loss of trade in Great Britain's older industries has compelled her to develop new ones, and to make difficult changes in her industrial organization. One of the important reasons for the recovery is the progress made in diversifying her exports and in establishing new products in the home market. These changes have been carried on under the protection of the tariff of 1932. Together with the depreciation of the pound, and subsidies and other measures for agriculture, this tariff gave domestic enterprises for a time what was perhaps the most extreme protection in the history of international competition. Under this cover the growth of new industries and those formerly of minor importance has been accelerated, as indicated by the shift in the make-up of the export trade, mentioned above. Mr. Beckett comments that "a number of the newer industries and trades appear among those which are now the most progressive".

Along with these changes older industries have been improved. In general the productivity of workers has been increased. Again quoting Mr. Beckett:

The output of steel ingots and castings last year was the largest ever recorded and that of pig iron the largest since 1929. It is interesting to observe as an indication of improving efficiency in this industry the reduction in the number of furnaces required to make a given quantity of iron. The iron produced in 1935 was made with 97 furnaces in operation, whereas in 1928, a year in which production was only a little higher than in 1935, the number in operation was 143. Fifteen years ago it would have required 227 furnaces to produce what was made in 97 furnaces last year.

The industrial shifts of the past few years have had a very important consequence. They have led to a migration of workers from Lancashire, stronghold of the cotton industry, from Yorkshire, seat of the woolen industry, and from the coal and shipbuilding areas to London and the South of England, where automobiles, radios and other expanding industries are located. This migration was under

way before the depression, and has been speeded up since, the influx into Southeast England (including London) in 1933 alone being estimated at 265,000 people. Here is one of the explanations of the great increase in home building which has been referred to.

The most difficult adjustments still to be made must fall on the coal, shipbuilding and cotton industries. The Government is sponsoring a bill, which has passed its second reading, providing for the purchase and retirement of an estimated 10,000,000 cotton spindles, out of a total of 43,000,000; the cost will be borne partly by a levy on the 32,000,000 which it is believed can be kept in operation profitably, and in part if necessary by the Treasury. This plan will obviously add to the costs of the 32,000,000, but most Lancashire manufacturers are said to favor it, and criticisms from this side of the ocean would hardly be becoming. However, workers are reported in opposition, on the ground that it makes no provision for those who are in danger of losing their jobs.

The surplus of coal mines and miners left by the loss of markets is an endless source of trouble, and a month ago a national strike was averted only by grants of wage increases and certain other measures looking to the establishment of national wage machinery and central selling schemes; in other words, something like the N.R.A. The wage increases will be financed, most unusually, by the "voluntary acceptance" by public utility companies and other large consumers of an increase in the price of coal. This inspires the "Economist" of February 1 to remark:

It would be fatal to suppose that the real problem of the coal industry has in any sense been attacked, far less solved. The owners have succeeded in persuading the public to pay more for their coal. They have not yet put their own industry in the state of efficiency which the underlying conditions warrant and the standard of living of the nation requires.

Easy Money and New Capital Issues

Unquestionably the easy money conditions existing in Great Britain have been a very important influence in the recovery, facilitating the industrial changes and stimulating expansion of the capital goods industries. The London capital market has had no field in which to invest during the past four years except the home field, for offerings of loans to countries outside the Empire have been banned, and in any event would not have been attractive under the existing conditions. Also, the market has been in funds through substantial receipts of foreign capital, and through the accumulation of funds formerly employed in trade; and the joint-stock banks have been free buyers of investments, for in Great Britain as well as this country bank deposits have set new high records, while the

increase in commercial demand for money has been very modest.

The outcome of this situation has been an abundance of capital for home needs, declining yields on securities of good grade, and a healthy increase in new capital issues. The Government has encouraged the development of easy money in every way, and took advantage of it as early as 1932 to convert the two billion pound 5 per cent war loan to a 3½ per cent issue. The step of course had profound effects in reducing the yield on all bonds, and lowering the cost of industrial borrowing. Last December the Treasury had extraordinary success in selling £100,000,000 of 3 to 5 year notes to yield an average of about 1½ per cent, and £200,000,000 of 20-25 year bonds at slightly over 2½ per cent. These were to refund two outstanding issues and to reduce the floating debt.

The volume of new capital issues offered to investors has increased steadily. The record as reported by the Economist is as follows:

	(Million £)			
	Refunding		New Money	
	Total	Total Exclud. British Gov.	Total	Total Exclud. British Gov.
1929.....			328.8	263.4
1930.....			291.7	226.1
1931.....			111.0	101.3
1932.....			204.5	101.8
1933.....	223.1	172.3	283.8	133.0
1934.....	241.9	136.9	211.4	167.3
1935.....	312.2	108.2	281.5	193.5

This improvement may undoubtedly be taken as evidence of the value of the balanced budget, reduced taxes, and confidence in the stability of the currency in stimulating lending, while the industrial changes growing out of the altered trade position created the demand for capital. In the building revival especially cheap money has been a principal influence; many of the new loans have been raised by public boards and municipalities, and the proceeds have been reloaned for construction.

Of course the low money rates present difficulties for banks and investors. Mr. Campbell of the National Provincial Bank expressed his regret that the ban on foreign lending has not yet been removed. It may be noted that an Australian conversion loan of £21,000,000 offered in the market in January to yield 3¼ per cent met a poor reception, which may indicate that money rates are expected to firm. If so, the possibility of a large Government loan for public works and armament is presumably the reason.

What is the Limit on Domestic Recovery?

In their addresses one year ago the bank chairmen were chiefly concerned as to whether there was scope for domestic improvement independent of world conditions. The experience of 1935 shows that there was more room for

a home recovery than all except Mr. McKenna of the Midland Bank, who pinned his faith on the efficacy of easy money, were then disposed to believe; and this year's addresses recognize that fact. Nevertheless this question is still the chief subject of speculation. If Mr. McKenna is correct production and consumption can go forward together as long as they can be financed, until the limit of the available labor supply is reached, i.e., until there are no unemployed except the unfit.

Evidently, however, there is another limit that must at some point become effective. As British production increases British imports of food and raw materials must also increase. To be sure the composition of imports may change, as it has already changed; Great Britain now buys less cotton, wool and sugar, and more copper, rubber and oil. But the important fact is that the greater the industrial activity the greater the necessary imports, and the ability to pay for imports is the limit upon a purely domestic recovery.

This brings the reasoning back to the need of improvement in the export trade and shipping services which the bank chairmen stressed so greatly. It is undisputable that imports can be paid for in the long run only by exports of goods and services. The most favorable factor in the export outlook is the improved purchasing power in the countries producing raw materials, due to the higher prices of their products, and naturally the domestic improvement in Great Britain contributes to world improvement through her increased purchases. However, if Britain is to share in world trade gains she will have to meet competition, which requires keeping her costs down, and this will compel the continued improvement and development of her industries.

The depreciation of the pound from the old gold value is no longer much of an advantage in competition, for other nations quickly learned the game. Also there were unfavorable developments in the past year, affecting the competitive situation, such as the Belgian devaluation, reduction of export costs in France, and the extension of the export subsidy system in Germany. English prices were rising toward the close of the year, wage increases had been granted in certain trades, and there was another increase last month in a laggard industry, namely the coal wage advance already referred to.

The initial effects of the tariff in stimulating domestic recovery are generally considered as having worn off, and the share of responsibility of the tariff policy, and the reprisals against it, for the world trade depression may require attention.

These are important matters. The hope is that the effects of the unfavorable factors will

be overcome by the world wide trend to recovery.

Wealth and Its Distribution

The articles of this series have been directed to two principal ends: first, to make real to the reader the long, groping, struggle by which mankind has acquired its present knowledge of the natural resources and the means of obtaining a livelihood from them; and, second, to show that the standard of living to which the people of this country are accustomed is possible only under the system of highly specialized industry and the accompanying exchange of services. By specialization in scientific research, in mechanical equipment, in labor and management, and with the aid of capital accumulations made possible by this combination, a vast organization of high productive capacity has been gradually developed for providing the forms of wealth that satisfy human wants.

This, in brief, is the economic system, just now enveloped in a fog of talk. Progress was very slow for thousands of years but in the last 100 years has been at a rapidly increasing pace. Every discovery in the sciences leads to others, and to new or better industrial products and more of them for common use. Nevertheless, from time to time complaints have been made that the changes were coming too fast and causing overproduction and unemployment.

The answer to all these complaints and proposals is that the signs alleged to prove *overproduction* do not prove it in any general sense, but invariably arise from *unbalanced trade*.

The law of the equilibrium is based upon the exchange of services, which makes it automatic and inexorable. The exchanges must settle themselves and to whatever extent they fail to do so a blockade ensues. Normally the system is guided by the law of supply and demand, which constantly exerts its influence upon both production and consumption, to maintain the equilibrium or restore it, but great disturbances, like a world war, overcome all normal influences and cause far-reaching derangements.

The Case of Agriculture

Agriculture has been in trouble ever since the war, and its over-expansion under the war stimulus is a familiar story, but there is also the problem of making continual adjustments to maintain the exchange relations between itself and the other industries. It is a well-known fact that over the last 100 years the share of agriculture in the national income has been declining, not because the income of agriculture was declining, for it was not, but because its principal source of income has been food products, of which per capita consumption is limited, while the national income from other sources has been increasing much faster.

For many years, agriculture has been losing its sons and daughters to the cities, and much of the time not fast enough to preserve the desired "parity" between urban and rural incomes, which is determined by proportional offerings in the exchanges. A policy that would check the movement would defeat its own purpose. An attempt to raise the compensation of any economic group to an artificial level would surely fail unless entrance to that group was restricted, and in that case a vested privilege would be established; or if all groups were treated alike the policy would be futile, for the exchange relations would not be altered.

The Population Factor

The census figures for Sweden from 1870 to 1930 show the total population of the country in 1870 to have been 4,169,000, of whom 3,117,000, or 72.4 per cent, were dependent for their living upon "agriculture and associated callings," while in 1930 the total population was 6,142,000, of whom 2,395,000, or 39 per cent, were classed under "agriculture and associated callings." This shows that the proportion of the population engaged in agriculture is now higher in Sweden than in the United States, but, as here, the trend has been downward. The farm population has declined actually in Sweden, but not in the United States. The cause of the shift of farm population in Sweden, as here, has been, the increasing efficiency of agriculture in food production, and the more rapidly increasing demand for workers in the other industries and occupations. This is the tendency in all advanced countries, and, as the situation doubtless is permanent, it is imperative that the distribution of workers shall be continually adjusted, in order to maintain the balanced exchange relations required for full employment.

Agricultural Products as Raw Materials

We were reluctant to close last month's discussion of the agricultural situation without mention of certain other factors in it. In the first place, the population of this country is still increasing, even though not so rapidly as in the past, and no doubt agriculture will gain with the other industries by a restoration of general prosperity. The arable land within our boundaries is practically occupied, and more is cultivated than should be. Genuine conservation of the national resources is a proper subject for consideration. Moreover, Europe may return to larger-than-present importations of our farm products, and is more likely to do so if we reduce our costs, instead of artificially raising our prices.

Furthermore, the discussion last month and above relates only to *food products*, and the best prospects for the farmers lie in the production of materials for the industries that are expanding more rapidly than agriculture. The raw materials of all the industries come from

the mines, the forests and the soil. In the past they have been used mainly in their natural state; or after simple processes of preparation; in the future they will be "processed," by a great variety of treatments. This will mean a larger volume of finished goods, larger use of raw materials, new opportunities for land crops, and more consumers outside of agriculture.

Developments in Chemistry

A new era of industrial progress has been ushered in by the development of chemistry since the war period. Chemistry is the science of "matter," the broad term applied to all substances. The early Greek classifications were earth, air, water, and fire, and apparently they knew little of the composite nature of either of these. In modern times the general classification is into "solids, liquids and gases," but these are transformable into each other under the influence of pressure and heat. Moreover, these substances are composed of distinctive "elements," of which 92 have been identified, and there may be more. Most of us know so little of even the most important ones that we have scarcely realized that they might have commercial values. We have not been buying them under their own names.

In the past, chemistry has been mainly analytical, which means taking substances apart, or separating their elements. Synthetic chemistry is putting elements together—building up new structures. Instead of having only the natural products for its materials, industry is now taking them apart and forming new combinations with the elements. This opens a vast new field for science, art and industry, with limitless possibilities for "exchanging services" more and more specialized.

A good beginning in the production of chemicals in this country already had been made before the war by industries wanting special supplies for their own operations or to utilize by-products of their chief activities. Thus was afforded a skeleton organization for rapid development, and the war-time business not only gave the stimulus but supplied the capital. A series of consolidations, both before and following the war, established four important chemical companies, each of which exceeds in capital investment and productive capacity any single foreign company in their lines, and has raised the total production of chemicals in this country to nearly one-half of the world's total.

E. I. du Pont de Nemours & Company, in its century-old business of manufacturing explosives had been developing experts in chemistry and had extended their activities beyond the original lines, but its major entrance into the organic chemistry industry was in 1917, when the United States entered the World War. Mr. W. S. Carpenter, Jr., Vice President of the Company, addressing a group of dye

works foremen at the Deepwater, New Jersey, plant a few months ago, said:

At the end of the first five years of these operations the du Pont Company had invested in this industry (dye stuffs and synthetic organic chemicals) \$22,000,000, and in addition had suffered operating losses aggregating \$18,000,000, making up to that date a total outlay of \$40,000,000 without a cent of profit. The investment has been largely increased in the thirteen years since that time.

This is the scale of development in the chemical industries since the date named. The chief expenditures by du Pont have been in the department of synthetic organic chemistry.

Besides E. I. du Pont de Nemours & Company the Allied Chemical & Dye Corporation and the Union Carbide and Carbon Corporation are chemical companies employing more than \$100,000,000 of capital each, and with large research staffs and a wide range of products. Other enterprising and successful companies, amply financed and leading in some fields, are the American Cyanamid Company, Dow Chemical Company, Monsanto Chemical Company, Mathieson Alkali Works, Air Reduction Company, Inc., Commercial Solvents Company, Hercules Powder Company, United States Industrial Alcohol Company, the American I. G. Chemical Company, Corn Products Refining Company, the Eastman Company, and numerous other companies in important special lines.

Chemistry and Agriculture

We have given this brief account of recent developments in the country's chemical industries to indicate that new forces will be stirring all of the industries, and probably with effects upon agriculture. Every industry is alert for cheaper or better materials, also for new products that have an appeal to the public; and the chemical laboratories are studying the 92 elements to discover what may be done with them.

The index price table of the Bureau of Labor shows the chemical group of products to be now below the 1913 level, although wages in the industry are approximately 100 per cent higher. The success that chemistry has had with its own products, suggests that it may be able to cheapen the many commodities that remain above the 1913 level. That would re-establish the 1913 parity in a very satisfactory manner.

At the opening on December 30 last of the annual meeting of the American Association for the Advancement of Science, an organization in which are affiliated 152 national scientific societies, the President, Dr. Karl I. Compton, also President of the Massachusetts Institute of Technology, speaking on the subject "What's Next in Science," named first the possibility of finding more uses for agricultural products. He said:

Agricultural research in the past has led to greater yields of improved farm products. The great problem

of agriculture today is to discover new uses for these products, uses which will create new social values or partially replace the consumption of our exhaustible natural resources * * * Experience justifies belief that, along such lines, science may create new demands for farm products which will provide a constructive and permanent solution of the agricultural problem. This would be an infinitely better solution than the present emergency expedient of paying huge sums to induce farmers to raise less—to plow under crops and slaughter stock, in order that the rest of us, who pay that bill, will also have to pay more for our food. I believe that no one, not even among its proponents, is enthusiastic about this destructive and temporary scheme to benefit agriculture.

Almost a year ago, steps were taken to form a scientific organization for this very purpose. The first meeting was held last May at Dearborn, Michigan, as the guest of Mr. Henry Ford. Many representatives of the chemical industries were present, and agreed to cooperate under the name of the "Chemurgic Society," in scientific efforts to develop new products from agricultural materials. All of the important chemical companies pledged the aid of their laboratories, the principal land grant agricultural colleges were represented and pledged their assistance, and the Chemical Foundation pledged the necessary funds for organizing expenses. Two meetings have been held since, and the program is developing.

The Corn Industries Research Foundation, with headquarters in Chicago, is another co-operative organization, of eleven corporate members, all producing corn products. Corn has been losing out for bread, but is used in making many new food products, as sugars, syrups, dextrine, starch, etc.; also in numerous manufactures, but has many competitors in other vegetable products, for example, black strap molasses, a by-product of the cane sugar industry.

Cotton has branched out from its chief use in the textile industry into many of the new cellulose products, such as motion picture film, rayon, cellophane and the numerous plastics that are made into an almost countless variety of things from toilet articles to house-furnishings, telephone equipment and even automobile parts. New methods have been found for using many other farm products in industry, such as milk, tobacco, flax, citrus fruits, olives, sugar, potatoes, soy beans, etc.; also for the distillation of timber and wood waste to make new chemicals, oils, various alcohols for special uses, resins, papers and cellulose products. The following are a few of the chemical products of comparatively recent appearance:

Anti-freeze compounds, new refrigerants of the "dry-ice" type, camphor (from turpentine), Cellophane (a transparent, impermeable paper), numerous cloth, leather and rubber fabrics (fabrikoid, tontine, etc., DuPrene), dyes, resin finishes and paints (as duco and Dulux), viscose rayon, modified lubricants for heavy duty, safety glass, plastic compounds (bakelite, celluloid, etc.), rust-proof steel, steel alloys and other metal fusions, wallboard and air-conditioning materials, solvents for dry cleaning, fertilizers, insecticides, casein products, many drugs and pharmaceuticals (as perfumes, extracts, essences, flavors, cosmetics, disinfectants, vitamins, insulin, the anti-

toxins, serums and "specifics" that have conquered diphtheria, typhoid fever, smallpox, wound infections, and brought even tuberculosis under control) and so on.

It should be understood that the "rubber" mentioned is not actual rubber, but a substitute that answers every purpose and for some uses is better; and so of "leather" and other familiar names.

The largest use of the new chemicals is as new ingredients of staple products, improving or cheapening them for their present uses. Last December a medal prize, offered by the magazine, "*Chemical and Metallurgical Engineering*" (McGraw-Hill, Publishers) and awarded by a committee of eminent chemical engineers, was presented to the du Pont Company for "meritorious achievement in the successful large scale production of the synthetic rubber 'DuPrene', of synthetic camphor and a variety of other essential organic chemicals and dyestuffs." Upon this occasion, Mr. Edmund G. Robinson, general manager of the organic chemical department of the Company, speaking of the new development in chemistry closed his remarks as follows:

It is obvious then that an organic chemical industry is a source of continual developments in the form of new aids to other industries and that its scope is limitless. It is equally obvious that the existence of such an industry is an essential factor in our national life. The new products and materials produced by organic chemistry enter our daily lives in a multitude of ways producing truly better things for better living.

An Era of Increasing Abundance

The most impressive feature of all this development is the abundance of the natural resources to supply the wants of man, and the rapidity with which they are now being utilized. The comparison with even one hundred years ago is very striking and should be inspiring instead of depressing. The rivalry of materials is a permanent feature of competition among the industries. It teaches the ever-recurring lesson of the necessity for constant adaptation to changing conditions. The best or cheapest will be used, to suit the tastes or pockets of consumers, and every one of us is in that class.

No longer ago than in eighteen-ninety-eight, Sir William Crooks, a distinguished English scientist, predicted that a dangerous shortage of food products would follow the early exhaustion of Chilean nitrates, but since then new processes for obtaining nitrogen from the atmosphere and other sources have forever disposed of apprehensions on that subject. Although this may provide for an increasing production of farm products, instead of an increasing demand, it is a major achievement for chemistry. It assures the maintenance of the soil resources, which is a matter of fundamental importance.

While there is little prospect of an early scarcity of petroleum or gasoline, the natural

supplies are being exhausted, and alcohol, from vegetable products, is a promising substitute. Here, again, as in the case of indigo, coal is a rival, for in Germany and England motor fuel is being made from coal by the low-carbonization process; but coal-mining is another depressed industry in need of relief. Whether the development shall be to alcohol or coal-oil it will be a chemical achievement, and another illustration of this industry's possibilities.

The Ford Motor Company has been experimenting with the soy bean, from which it obtains oil of about the quality obtained from linseed and a meal that is well-suited for moulding into automobile parts. Tests have been so satisfactory that the Company is building a mill, estimated to cost \$4,000,000, for the employment of this process. The bean production of 50,000 acres will be required by the Ford Motor Company in 1936. It is said that the substitution of the bean meal for steel in certain parts will reduce the weight of the Ford car by twenty pounds. This is a gain by the vegetables group from the metals group. The group of materials known as plastics, suited to the moulding process, has been gaining in importance and much more might be said of it.

Cellulose Products

By far the most signal development in the field of raw materials in recent years has been in the group classed as cellulose products. The woody fibers of all plants are mainly cellulose. The cotton boll has long been the most available supply for cloth making, but the advance of chemistry in recent years has opened new sources. A new industry has been created, based upon the fibers of soft woods, and occupying a place between the paper industry and the old textile industries making woven goods. It has silk-like qualities and at first was called "artificial silk," but as it gradually established its position in the markets the trade name "Rayon," was agreed upon. The development of the rayon industry before the war was experimental, but since the war it has grown by leaps and bounds. In 1920 the production of the United States was 9,000,000 lbs., in 1934 it was 210,300,000 lbs. and in 1935 is estimated at 250,000,000 lbs., or about two pounds per capita, which is four times our present absorption of silk. World production of rayon in 1920 was 50,000,000 lbs., in 1934 was about 800,000,000 lbs., and in 1935 is estimated by the "Textile World" at nearly 960,000,000 lbs. Thus here is a great new industry based on the land, and already giving employment to many thousands of workers, most of them from farms, and relieving the pressure there.

Down until about the eighteen-sixties cotton and linen rags were the only materials for making paper, excepting straw for the low

grades. Then came the series of processes for making pulp from the soft woods. The problem was to eliminate the glutinous substances holding the fibers together. The early processes were by the use of lime and caustic soda, later ones by the use of sulphite and sulphates. Thus paper-making is a chemical industry, and thanks to it, with the modern type-casting machines and printing presses, daily newspapers and books in abundance have been brought within reach of all the people.

The Old and New Forests

Much has been written in the past, and still is written, about the "slaughter" of our forests, and the "greed" of those who did it. Of course, the "slaughter" has been incidental to the increase of population all the way up to 127,000,000, the building of cities, farm homes, railways and other development. In other words, the people needed the forests and used them and the settlement of the country was facilitated by these resources. They were "exploited" as cheaply as then seemed practicable, for competition determined both price and costs. The practices were wasteful, judged by later values, but future generations may say the same thing about our consumption of coal and petroleum for fuel, neglecting the valuable by-products. But here is a sequel:

The Southern states originally had a large area covered by the hard pine, most of which has been cut away and followed by a growth of scrubby "slash pine," in the past counted of little value. Here again the advance of chemistry has created values out of a troublesome encumbrance. Fifteen years ago there was no known use for this second growth pine, but today one-half of the so-called "kraft" papers—for wrapping, paper bags, etc., is made from it. Furthermore, the friends of the slash pine have grown ambitious and claim to have demonstrated that any quality of paper can be made from it, and that they will be doing it soon on a commercial scale. Savannah, Georgia, is the headquarters of this development and Dr. C. H. Herty, a native Georgian, a scientist of distinction and a former President of the American Chemical Society is the Director of Research. Dr. Herty is saying that "from existing stands of pine, this country's entire needs of paper and pulp can be amply filled in perpetuity."

According to his representations this pine grows so rapidly in the southern climate that a ten-year cycle of production, "embracing a food crop, pulp wood, pasturage for cattle, and naval stores," will enable the South to make paper at lower cost than any competitor. The quick-growing pines are said to make good pulp for rayon and other cellulose products, and this promises not only a new crop for the southern lands but raw materials for

new industries, and more employment for consumers of all farm products. More area elsewhere can be devoted to the hard woods.

The Cement Industry

The reader at first thought might not class the making of cement as a chemical industry, but Portland cement is distinctly a chemical product, and the industry is deserving of mention here. Concrete is a conglomerate of sand, rock, and other enduring materials with cement as the binding element. Natural concrete made of natural blends is a very old building material, and ancient structures of it endure to the present day; but Portland cement, made by a scientific selection of materials and fused by fire, is only about 100 years old.

The beginnings of the industry in this country occurred in the eighteen-seventies, and the manufacturing methods have been made all over since then, prices halved, average wage rates multiplied three times, and production increased from 42,000 bbls. in 1880 and 8,000,000 in 1900 to a peak of 176,000,000 in 1928. As introduced from Europe, the industry followed the "batch" method of treating raw materials with repeated handlings by manual labor. It has been made a continuous process, with all crushing, mixing and handling done by powerful special machinery, largely automatic in operation. The investment is large, the product must be cheap to obtain a large volume of sales (average factory value in 1928, \$1.59 per bbl.), and the volume must be large to make a profitable business.

The moving charge of materials is reduced to powder, and the mixture continually tested by chemists. The kilns are revolving steel cylinders 125 to 325 feet long, 8 to 14 feet in diameter, and set at an incline that causes the contents to move gradually from the upper end to the lower; the fuel is oil or pulverized coal, which enters at the lower end, and the heat is drawn by a draft through the sliding and revolving contents with increasing intensity until in the zone where the flames play directly upon them the chemical change known as "fusion" takes place. The product of the kiln, known as "clinker," is reground, and becomes "Portland cement."

The industry has had to meet much higher labor costs in recent years, not only in its own plants, but in its materials. An authority says:

In 1912 it cost 6.33c to move 100 pounds of cement 191 miles, while in 1935 the cost is 13.2c, an increase of more than 100 per cent. In 1912 coal cost an average of \$1.98 per gross ton; in 1935 it cost \$3.20 per gross ton, both f.o.b. mine, an increase of 70 per cent, approximately. In 1912 gypsum cost \$4.163 per net ton, while in 1935 the cost was \$5.028 per net ton, more than a 20 per cent increase. Limestone in 1912 cost \$1.055 per ton and in 1935 cost \$1.48 per ton, an increase of 40 per cent, approximately. Taxes and miscellaneous are up likewise.

These increased costs have been met in part by additional investments to reduce the man-

hours per ton of products, by conserving fuel and heat and reducing power costs, the results of continuous study.

Working conditions for labor have been greatly improved, not only by the use of machinery but by protection from dust that at one time was a menace, and by a shorter day. The average wage has advanced more than in keeping with the general movement, because the industry requires more skilled labor than formerly, a characteristic of machine production.

"Portland" cement is now a highly standardized product, made to specifications prescribed by engineering authorities. The mixing of concrete also has become a mechanical process and is done more surely than formerly by hand. Concrete made in this manner is practically imperishable and cheaper in a structure than any other material. Its use for highways and hydro-electric projects for providing light, power and water supplies has made it an important factor in community life.

Boulder Dam

The greatest monument to the cement industry is Boulder Dam, which, including appurtenances, will require 5,500,000 barrels of the product.

One feature of the dam construction is deserving of mention as one of the most notable feats of engineering science. The engineers of the Reclamation Service were faced with the problem of controlling the temperature of the huge masses of concrete that would be placed so rapidly as to create conditions not experienced before. It was foreseen that the speed of construction would not afford opportunity for the natural dissipation of the heat resulting from the chemical reactions that take place in hardening. Since the heat would cause expansion, there was danger that the cooling would produce cracks, with resulting leaks and possible instability. The problem of the engineers was to control the heat so that the joints could be grouted under conditions of temperature and expansion corresponding to those that will prevail in the future. An informed writer has described this achievement as follows:

Cooling was accomplished by embedment in the concrete of 800,000 feet (150 miles) of 2-inch pipe through which river water and then refrigerated water was circulated until the temperature throughout each section of the dam was exactly that which will prevail when the upstream face is exposed to the constant temperature of a lake 600 feet deep and the downstream face to the mean annual temperature in the canyon.

Reduction in the heat generated by the hardening cement was accomplished by the use of a special

cement, low in heat generation, and concrete mixtures designed to reduce to a minimum the quantities of cement required. Through the work of the research laboratories of the Portland Cement Association there was available to the Bureau of Reclamation at the beginning of these studies the fundamental data on concrete mixtures and cement composition upon which the solution of the problems must rest. All of these data were placed at the disposal of the Reclamation Bureau and a representative of the Association served on the Consulting Board which outlined and supervised the special studies required.

As a result of these studies a cement was developed which served the intended purpose with marked success. The engineers were able to complete this unprecedented structure nearly two years ahead of time, cooling and grouting the joints to a predetermined schedule with an exactness that would do credit to any manufacturing process where refined methods have long been in use. The cement industry takes just pride in its contribution to this great achievement of the Reclamation Bureau engineers.

The dam and power house, now completed, have cost approximately \$100,000,000 and the entire project is estimated to cost \$165,000,000. Three considerations prompted the huge undertaking, to-wit: control of the Colorado river floods, which have threatened the Imperial Valley; provision of a much-needed water supply for the growing population of Southern California; together with electrical energy for light and power. All of the power available from the dam was contracted for in advance by the corporations and municipalities operating power and light utilities in Southern California. Including the costs and losses of transmission, the cost of current from the dam at present contract rate will not be less than present costs of generating it on the spot by the most modern steam plants. This statement appears in the latest report of the Southern California Edison Company (one of the contracting parties) to its shareholders. Thus it appears that control of the river and assurance of water supply were the principal considerations behind the project.

The foregoing review of progress in the chemical industries, including the manufacture of cement and concrete and the construction of Boulder Dam, together with preceding accounts of the development of steam and electrical equipment for generating and transmitting power, are all a part of the history of the evolution of the economic system and of its services to the common welfare. These are the achievements of specialists, not only in the industries named, but in all parts of the interdependent system. It seems in order to ask again: "Should this Progress be Stopped?" Should the working time of the industries be shortened to cancel the benefits of such developments? Should we be panic-stricken at the thought of an ever-increasing abundance of things that everyone wants?

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